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54. Name of Invention: Grinding Belt and Its Manufacturing Method

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DETAILED DESCRIPTIONS

1. Name of Invention
Grinding belt and its manufacturing method.

2. Patent Claims
1) A grinding belt in which a flexible material is used as an endless supporting belt; columnar grinding stones which containing circumferential stoppers around their side; the multiple grinding stones, which passes through the belt vertically, are distributed evenly over the belt; and the surfaces of the grinding stones, mentioned above, are parallel to the surface of the supporting belt, and have uniform heights, forming a single body with the supporting belt.
2) Manufacturing method for a grinding belt in which there are at least two overlapping supporting belts, which have through holes (openings), located at the circumferential side surface stoppers of the columnar grinding stones, such that after the grinding stones passed through the openings, the upper and lower supporting belts are moving in opposite directions, thus making the opening smaller, so that the grinding stones are secured in the through holes and can not fall off from the supporting belt.
3) A manufacturing method for a grinding belt, in which grinding stones are allowed to piece through the meshes of a net like structure, which is used as a supporting belt; after matching the stoppers of the grinding stones, mentioned above, with the meshes of supporting belt, the supporting belt is stretched in the length direction, shrinking the size (width) of the meshes, thus locking the grinding stones in the meshes of the supporting belt, and the grinding stones can not fall off from the belt.
4) A manufacturing method for a grinding belt, in which during the weaving process of the supporting belt, the grinding stones are placed vertically through the texture (openings) of the horizontal surface of the supporting belt, so that the two are weaved into an unified weaved structure.
5) A manufacturing method for a grinding belt, in which during the net making process of the supporting belt, the grinding stones are placed vertically through the openings of the horizontal surface of the supporting belt, so that the two are forming an unified net structure.

3. Detailed Description of Invention

[Fields of Technology of Invention]
This invention concerns a grinding belt used for the grinding of manufacturing goods, made from various qualities and properties of materials, such as, metals, plastics, wood and lumber, and stones, etc..

[Technological Background of Invention and Their Problems]
It is well known that conventionally, the endless grinding belt used for such purposes, are prepared from the coa-

ting of small abrasive particles on the surface of a substrate (belt, or sheet), such as cloth or paper, etc., using an adhesive. However, the performance and strength of the travelling grinding belt, mentioned above, depends primarily on the adhesion between the abrasive materials and the substrate; for conventional travelling grinding belts, the contact areas between the abrasive particles and the substrate are very small, during grinding, the abrasive particles are very easy to come off from the substrate, thus limiting its range of applications; for example, it is used only in light duty operations, such as rust removal and polishing of metal, and surface polishing of wood and lumbers, etc., and is not used at all in rough and heavy grinding operations, such as the common rotating grinding wheels (grinding machine).

[Objectives of Invention]

The objectives of this invention are to provide a grinding belt as well as manufacturing methods for such grinding belt. In order to resolve the problems mentioned above, the invention changes the basic approach of adhesion of abrasive particles to the surface of the substrate, by using completely unique manufacturing methods, the tensile strength of the substrate, shapes of the polishing material, and the bonding strength of the two are changed and increased; not only the performance as conventional endless belt is improved, but also obtains superior performance similar to grinding wheel used in rough grinding and other heavy duty grinding operations.

[Outline of Invention]

To achieve the objectives mentioned above, this invention has developed grinding belts the structure of which is outlined below. A flexible material is used as the supporting structure in an endless belt, many columnar grinding stones, with stoppers around its peripheral, are placed and distributed uniformly through the support vertically; the end surfaces of the grinding stones are parallel to the supporting belt, the stones have uniform heights, forming an unified structure with the supporting belt.

The manufacturing methods for the grinding belt mentioned above are as follows:

A) Two or more supporting belts, with through holes for retaining the grinding stones which contain stoppers are overlapping with each other; after the grinding stones are put through the openings, the upper and lower supporting belts are then moved in opposite directions, shrinking the size of the openings, thus secure the grinding stones inside the through holes of the supporting belts, such that the grinding stones can not fall off from the supporting belts.

B) Grinding stones are placed inside the meshes of a supporting belt with a netlike structure; after matching the stoppers on the grinding stones with the openings of the meshes of the supporting belt, the supporting belt is stretched in

the lengthwise direction to shrink down the size (width) of the meshes; thus secure the grinding stones inside the meshes of the supporting belt, such that the grinding stones can not fall off from the supporting belt.
C) During the weaving of the supporting belt, grinding stones are placed through the openings of the web at a right angle to the horizontal supporting belt, forming an unified weaved structure.
D) During a net making process of the supporting belt, grinding stones are place through the openings of the net at a right angle to the horizontal supporting belt, forming an unified net structure.

The belt like grinding wheels of this invention are manufactured basically by the methods listed in (A) through (D).

[Application Examples of Invention]

The structures and manufacturing methods of the grinding belts of this invention are explained below specifically using the figures in the application example. Grinding belt G in Figure 1 is the most representative actual structure of an example of this invention, which consists of many small pieces of columnar grinding stones 1s supported by an endless supporting belt 10. The grinding stones 1s are formed by the sintering and hardening of abrasive particles, consist of very hard material, and organic or inorganic adhesives; they are small columnar pieces, as shown in a, b, c, and e, of Figure 4, with circular, square, rectangular, hexagonal (tortoise shell shaped), or "〈" letter (Japanese alphabet character) shaped cross sections; around the middle or the bottom portion of the grinding stones 1s, there are (indented) grooves 2s or steps 3s, which can be replaced by raised bands 4s, or protrusions 5s, which served as stoppers 6s, as shown in Figure 5. The supporting belt 10 can be formed with a belt shaped steel, synthetic resin or rubber sheets, papers, cloths, woven and non-woven fabrics, metal screens (nets), or synthetic resin nets, etc., materials; the sur-face of the supporting belt 10a, as shown in Figures 8 to 11, in the case of steel, etc., sheet materials, are punched with many evenly distributed of holes with various shapes, such as circles, squares, rectangles, hexagons and "〈" shaped openings corresponding to the shapes of the grinding stones 1s; and in the case of woven fabrics or net like materials, the openings 12s and 13s are conforming to the sizes of the grinding stones 1s; many evenly distributed grinding stones 1s, place through and secure vertically on the inside of the openings 12s and 13s, which replace the through holes, on the supporting belt 10, mentioned above; the surface 1a's of various grinding stones are parallel to the surface of the supporting belt 10a, the grinding stones have uniform heights, forming an unified structure with the sup-porting belt 10.

Any of the following four methods may be used to join the grinding stones 1s with the supporting belt 10, for the manufacturing of the grinding belt, mentioned above.

First, in the first method (A), two or more supporting belt 10s, with through holes 11s, or (which can be replaced with) meshes 13s, are overlapping and matching each other, after each of the grinding stones 1s is placed pass the through holes 11s or meshes 13s, the supporting belts 10s are moving and stretching in the opposite directions, as shown in Figure 2, the stoppers 6s on each grinding stones 1s are entrapped on inside edges of the through holes 11s or meshes 13s of the supporting belts 10s, such that the grinding stones 1s are secured and can not fall off from the supporting belts; in the second method (B), in the case where the supporting belt has a net like structure, after the grinding stones 1s are placed through the meshes 13s in the supporting belt 10, the supporting belt is stretched from both ends in the lengthwise direction such that the size of the opening is shrunk at a right angle (to the direction of stretching), as shown in Figure 3, such that the grinding stones 1s are secured and can not fall off from the supporting belt in either up or down directions, forming a unified structure. In these cases, the stretching movement in the lengthwise direction of the supporting belts 10s of methods (A) and (B), mentioned above, may be carried out in an endless belt type grinding stones Gs, as shown in Figures 6 and 7, in which the belt is wrapped around the driving roll 7, or stretched between the driving roll 7 and the driven roll 8, in a grinding machine, respectively.

In the third method (C), the grinding stones 1s are not mounted into the meshes after completion (weaving) of the supporting belt 10 to form a grinding belt, but rather, during the weaving of the supporting belt 10, the grinding stones 1s are weaved into the meshes 12s of the said horizontal supporting belt 10, and placed through the openings vertically, forming an unified weaved structure; similarly, in the fourth method (D), the grinding stones 1s are not installed into the net openings after completion of the supporting belt 10 to form a grinding belt, but rather, during preparation of the net supporting belt 10, the grinding stones 1s are fit through the net openings 13s of the horizontal supporting belt 10, and are at a right angle with the supporting belt, forming an unified net structure.

[Effects of Invention]

As mentioned above, because the grinding belts, manufactured by the methods of this invention, consist of endless belt like supporting belt prepared from a flexible material, multiple columnar grinding stones, with stopper around the side, are installed by placing vertically and evenly distributed over the belt; the end surfaces of the grinding stones are parallel to the supporting belt surface and have uniform heights, forming a unified structure; the grinding stones themselves have excellent grinding strength

and durability, and supporting belts are freely selected from materials which are difficult to bond to, such as wire, rubber, and metal screens, etc., the grinding stones have outstanding bonding strength to the supporting belt, during its usage, the abrasives will not fall off easily from the supporting belt, allowing one to perform rough and heavy grinding of metals and stones with very high efficiency, which are not possible until now, thus expand the applications range of this type of moving grinding belts enormously. And in this invention, the grinding stones are supported with a supporting belt, such that the outside and inside can be reversed, allowing utilization of not only the outside surface but also the inside surface of the grinding stones for grinding operations; furthermore, because, depending on the required objectives and applications, by using various processes from (A) through (D), mentioned above, this invention can provide a grinding belt with excellent performance and at an extremely low cost, resulted in substantial contribution in the development of the (grinding) industry.

4. Brief Explanations of Figures

Figure 1 is a plane view showing an example of a specific actual structure of a grinding belt of this invention; Figure 2 is a cross sectional drawing showing the joining operation of the grinding stones with the supporting belt, during the manufacturing of the grinding belt; Figure 3 is a plane view showing the joining operation of the grinding stones with the supporting belt, in another application example; Figure 4, a, b, c, d, and e are bird's eye views showing various shapes of grinding stones; Figure 5, a, b, c, d, and e are front views showing the shapes of the stoppers on the sides of the grinding stones; Figures 6 and 7 are cross sectional views of mounting conditions of the grinding belts during their usage; Figures 8 through 11 are plane views showing the joining conditions of the grinding stones and the shapes of the supporting belts in other application examples.

G: grinding belt	1: grinding stones	1a: end surface
2: indented grooves	3: steps	4: protruded band
5: protrusions	6: stoppers	7: driving roll
8: driven roll	10: supporting belt	10a: supporting belt surface
11: through holes	12: weave openings	14: net openings

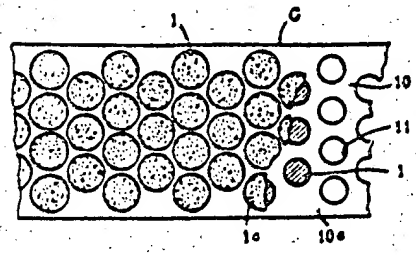

Figure 1

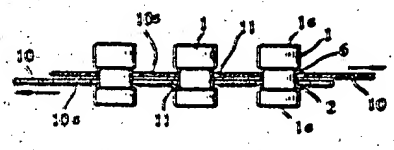

Figure 2

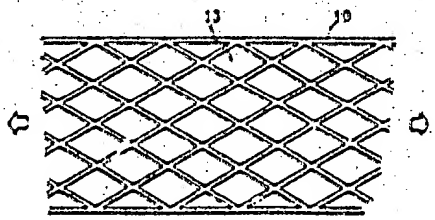

Figure 3

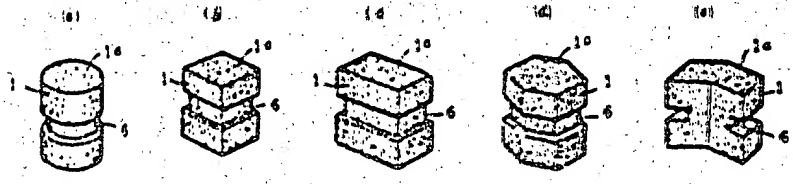

Figure 4

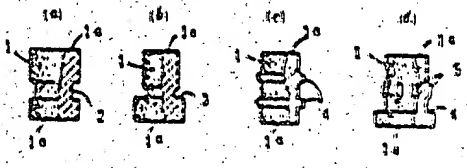

Figure 5

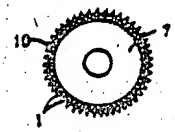

Figure 6

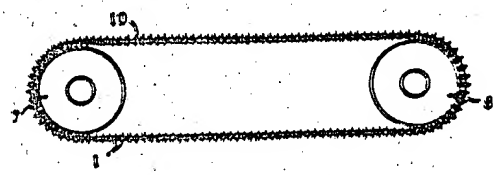

Figure 7

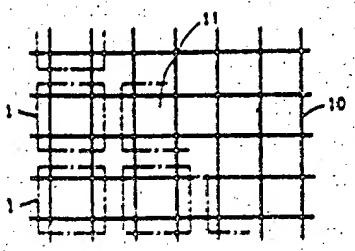

Figure 8

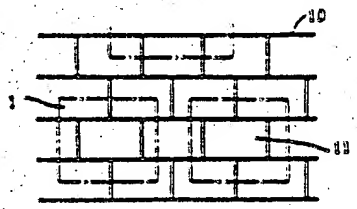

Figure 9

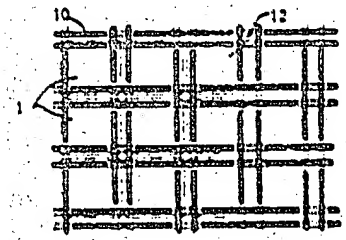

Figure 10

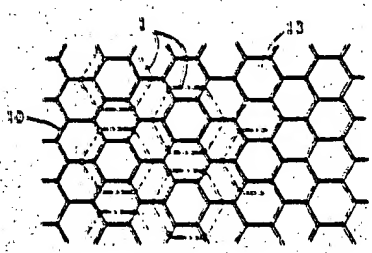

Figure 11